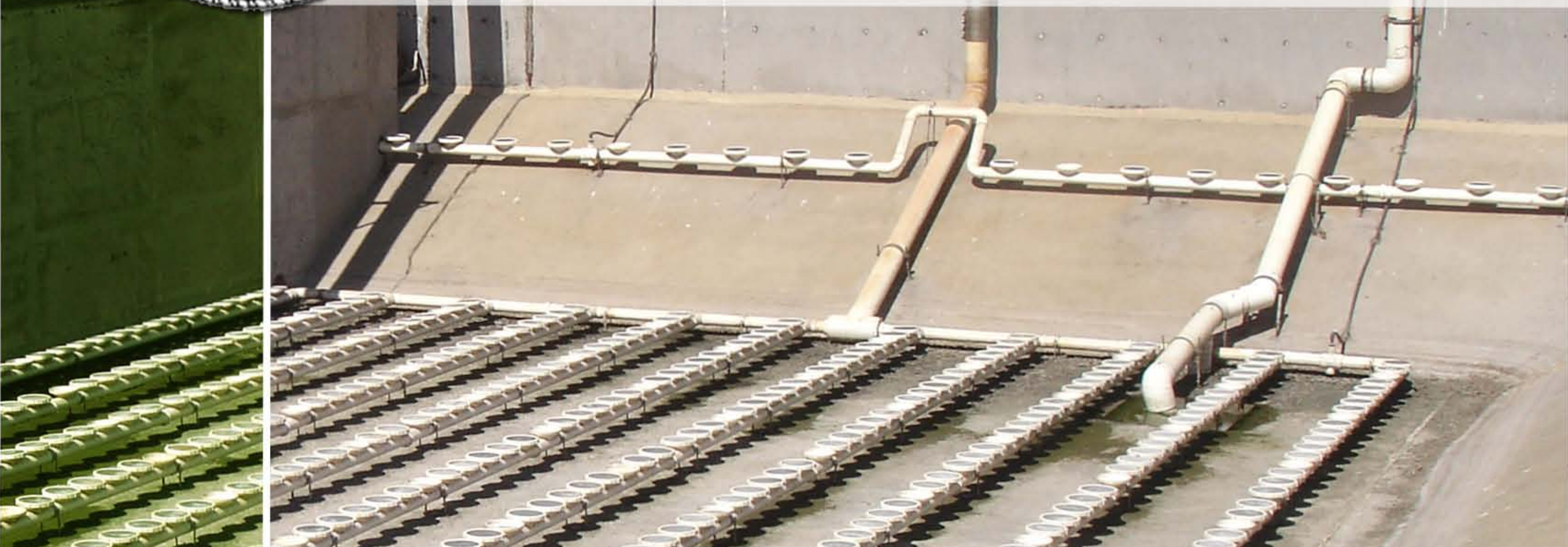
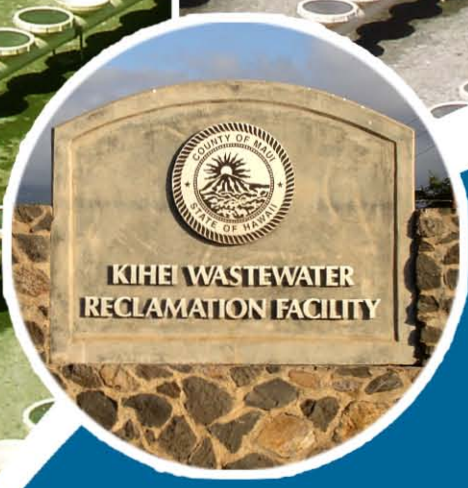
Energy Assessment Report for

County of Maui

Kihei Wastewater Reclamation Facility





U.S. Environmental Protection Agency Region 9
Kihei WWRF is located at 480 East Welekahao Road,
Kihei, Hawaii

April 14, 2010

SECTION 1
Executive Summary

Under contract to USEPA, Tetra Tech, Inc., (Tetra Tech) performed a site energy assessment of the Kihei Wastewater Treatment Plant (WWTP) facility. The facility is located on the island of Maui at 480 East Welekahao Road, Kihei, Hawaii. Representatives from the Kihei WWTP provided access to the facility and they also provided valuable information and data on the Wastewater Plant operations including site energy use, equipment, systems, and operations.

Based on observations during the assessment, energy conservation opportunities (ECO) were identified and are summarized in Table 1-1.

Table 1-1: Summary of Energy Conservation Opportunities at the Kihei WWTP

ECO No.	Recommendation	Potential Energy Reduction (kWh/yr)	Potential Demand[1] Reduction (kW)	Potential Water Reduction (Gal/yr)	Potential Cost Savings ($/yr)	Estimated Implem. Cost ($)	Simple Payback (Years)
Investment Grade Measures							
1	Effluent Water Management	26,000	10	0	$7,000	$25,000	3.6
2	Lighting System Improvements	22,700	4	0	$5,000	$43,000	8.6
3	Compressed Air System Improvements	105,700	6	0	$20,500	$130,000	6.3
Total Potential Electrical Energy Savings		**154,400 kWh/yr**					
Total Potential Electrical Demand Savings			**20 kW**				
Total Potential Water Savings				**0 Gal/yr**			
Total Potential Cost Savings					**$32,500 $/yr**		
Total Estimated Implementation Cost						**$198,000**	
Total Simple Payback							**6.1**

<u>Table 1-1 Notes:</u>

1. Potential Demand Reduction (kW) = Estimated billing demand reduction.

ECO = Energy Conservation Opportunity
kWh/yr = Kilowatt-hours per year

kW = Kilowatts
Gal/yr = Gallons per year
$/yr = Dollars per year

ECO No. 1. Replace current lighting technologies with higher efficiency lighting technologies.

ECO No. 2. Install new, higher efficiency, plant air compressors and auxiliary system components to provide for improved modulation control and resultant operational use.

ECO No. 3. Install improved monitoring and controls at the plant effluent and reclaim water system in addition to providing a water balance study of the plant and reclamation water end users to determine necessary line pressures.

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SECTION 2
Introduction

In 2009, Congress passed the American Recovery and Reinvestment Act (ARRA) which contains funding for Environmental Protection Agency (EPA) Region 9 States (AZ, CA, HI, NV), federally recognized Tribes, and Island Territories (America Samoa, Commonwealth of the Northern Marianas Islands, Guam) (States) to construct water infrastructure. ARRA promotes sustainable water infrastructure practices by requiring 20% of the funding to be directed to energy efficiency, water efficiency, green infrastructure, and/or other innovative environmental projects through the Green Project Reserve (GPR). GPR projects are identified on each State’s Intended Use Plan, workplan, or Interagency Agreement developed specifically for the funding received under ARRA.

This report was prepared by Tetra Tech in support of EPA Region 9 Water Division in implementing the GPR requirements of ARRA. Mr. Donald King and Ms. Kim Williams conducted the field audits, analyzed site data and drafted the following report under project manager, Victor D’Amato. The EPA Region 9 provided for the Energy Assessments at four Wastewater Treatment Plants (WWTP) on the islands of Hawaii. Those sites selected for evaluation included:

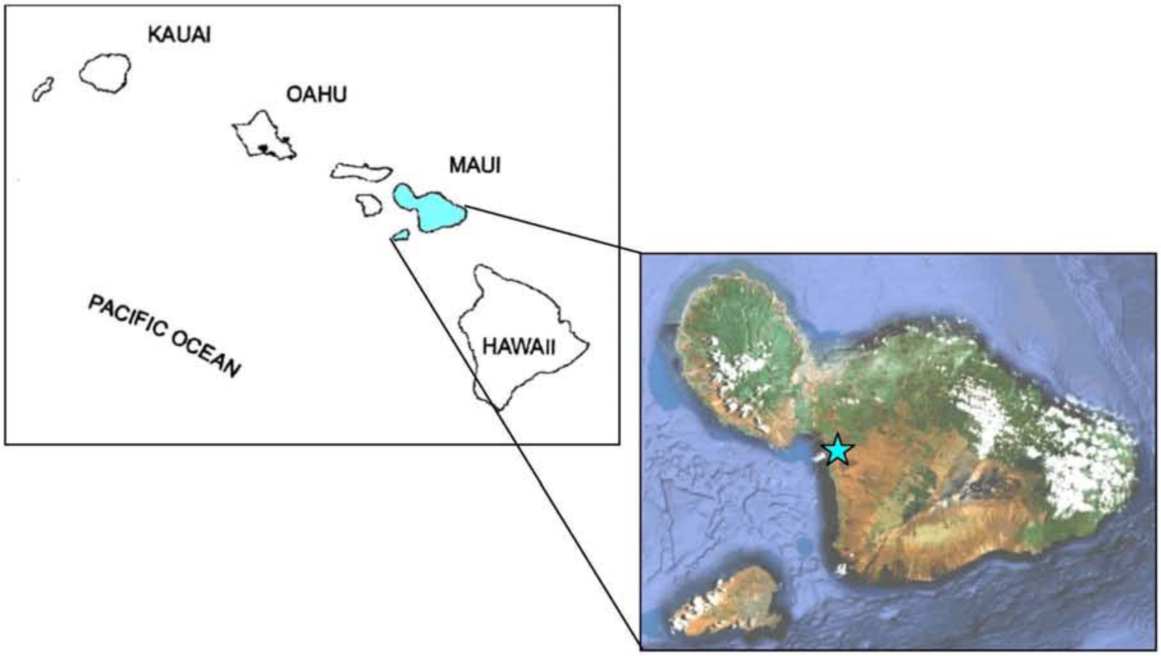
- Hilo WWTP – located on the island of Hawaii.
- Kailua WWTP – located on the island of Oahu.
- Kihei WWTP – located on the island of Maui.
- Waimea WWTP – located on the island of Kauai.

SECTION 3
Wastewater Treatment Plant Description

Location

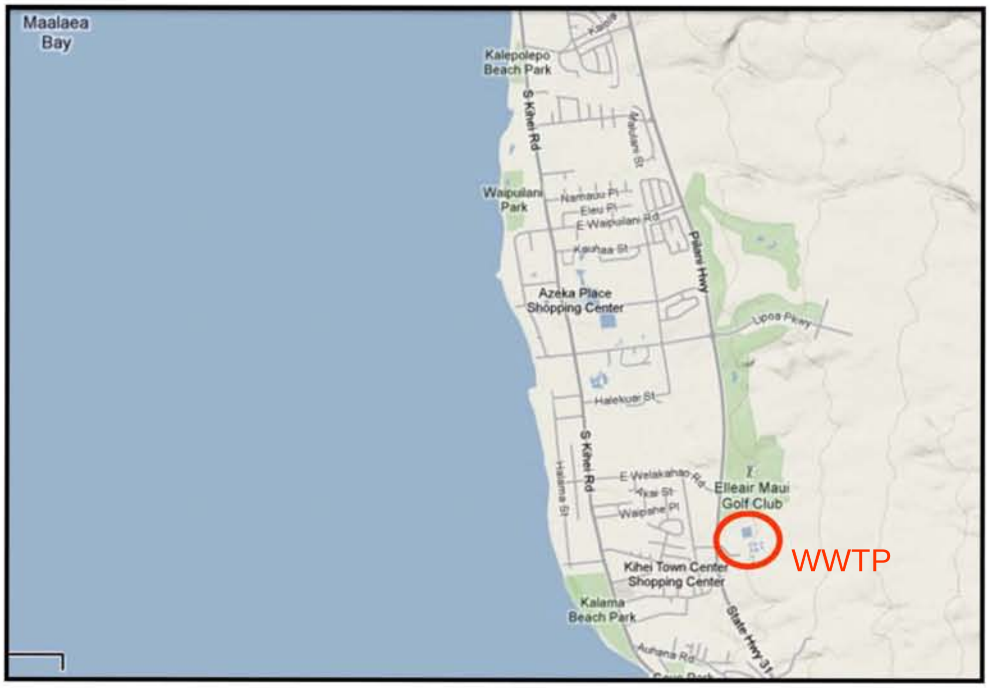
The Kihei Wastewater Treatment Plant is located at, 480 East Welekahao Road, Kihei, Hawaii. As shown in Figure 3-1, the facility is located on the south shore of the Island of Maui.

Figure 3-1: WWTP Island Vicinity Map



The facility is located just adjacent to the south shore in the town of Kihei along State Highway 31, also known as the Piilani Highway. The service area sewage is collected and conveyed to the Kihei WWTP via a series of gravity systems and pump stations. Figure 3-2 provides a vicinity map of the area and the treatment plant location.

Figure 3-2: WWTP Island Vicinity Map



The Kihei Wastewater Treatment Plant was originally built in 1965 to serve the town of Kihei and surrounding communities. In 1998 the plant underwent a major expansion and upgrades.

The WWTP is a water reclamation facility (WRF) comprised of four process areas, including the primary, secondary treatment advanced water facility, and the solids handling areas. The effluent is disinfected and reused at the adjacent golf course and local green areas. Back-up effluent disposal is provided at three injection wells located at the treatment plant. The facility has a waste discharge permit.

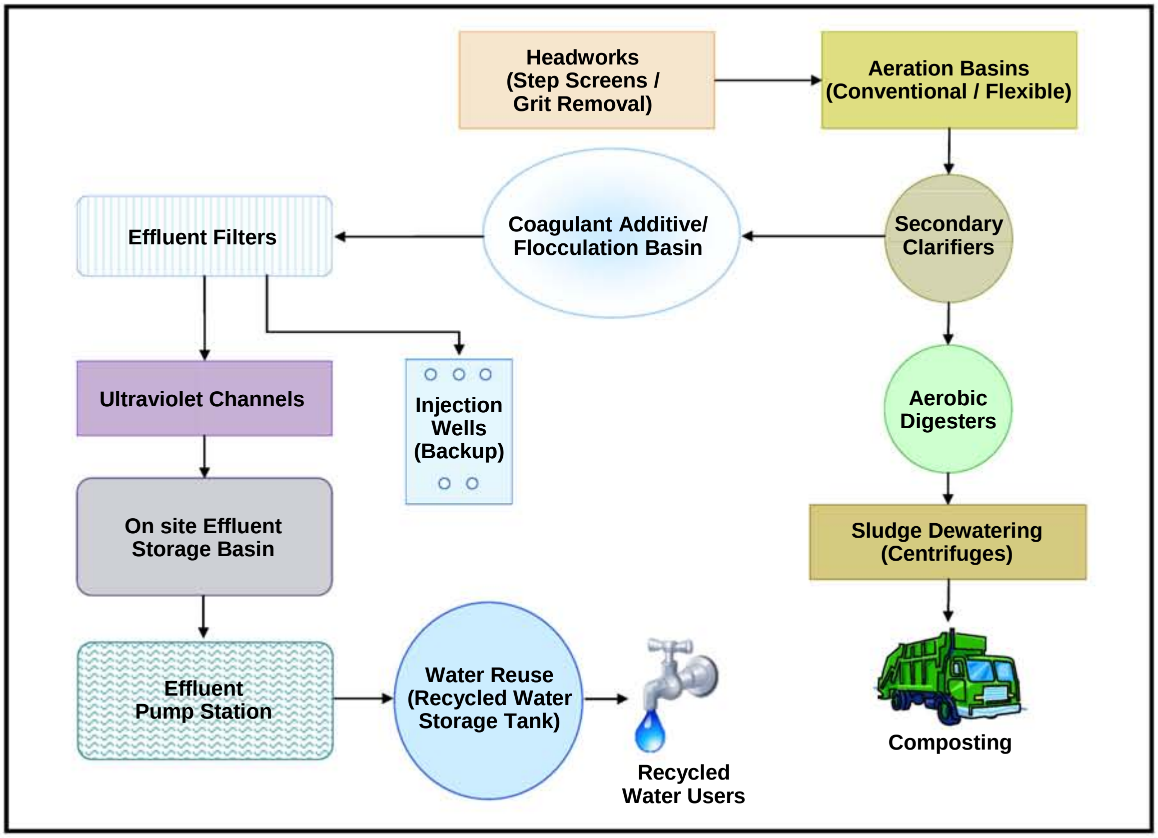
WWTP Operating Schedule

The plant maintains a staff of approximately 6 full-time operators during the week. Daily operations are typically staffed from the hours of 7:00 a.m. to 3:30 p.m., Monday through Friday. The site is also staffed with approximately half the employees loading on one shift for Saturday and Sunday. Operators are on standby during the evening hours.

WWTP Process - Overview

The treatment plant has a design capacity of 7.5 million gallons per day (MGD) monthly average, with a peak hourly maximum of 15.0 MGD. Currently, the facility is operating at 3.5 MGD and has seen a reduction in influent flow due to the downturn in tourism on the island. Figure 3-2 provides a schematic of the major treatment processes and plant flow.

Figure 3-3: Plant Flow Diagram



WWTP Process

The flow enters the facility via offsite pumping stations. Influent wastewater is measured with an inline flow meter and is mechanically screened with three Tea-Cup grit removal units. The headworks area is equipped with an activated carbon odor control system.

The wastewater gravity flows through to the aeration processes. Two types of aeration basins are provided including two conventional fixed diffuser basins, and two flexible membrane type. The flow is diverted to the two aeration systems with flow control gates. The aeration air is provided by a new variable flow air blower (Turblex Unit). The aeration air is set manually and automatic dissolve oxygen controls are being considered. Biomass laden wastewater is channel conveyed to the four secondary clarifiers. The secondary clarifiers allow a quiescent period of approximately 2 hours for biomass settlement. Approximately 90% of the biomass is pumped back to the aeration basins as return activated sludge (RAS) and a small portion, approximately 10%, is pumped to the aerobic digesters as waste activated sludge (WAS).

Secondary effluent flows to the coagulation/flocculation/chlorine contact basins for chemical addition and mixing. The coagulated effluent is passed through final effluent filter media and to the ultraviolet (UV) disinfection process area. Disinfected effluent is pumped to the on-site flow equalization storage pond, and the effluent pump station conveys the water to the reclaimed water distribution system and reservoir.

In the event the effluent pump station fails, or the reclaim water reservoir and distribution system attains maximum storage capacity, the fail-safe disposal method utilizes on-site injection wells.

Solids (WAS) from the secondary clarifiers are pumped to two aerobic digesters where process air is continuously added with aeration blowers (separate from secondary system). The agitation/mixing air is provided and the volatile solids reduced prior to dewatering.

After the sludge has been digested, a centrifuge station is provided to dewater the sludge prior to on island composting and reuse.

The facility is equipped with various support systems including: odor control for the headworks, plant air, plant water, emergency power, and chemical handling.

The main energy users within the facility are the aeration blowers and effluent pumping. It should be noted that several energy efficiency measures have recently been installed or are due to be installed in the near future.

Table 3-1 provides a summary of major equipment, estimated annual operational hours, and annual energy usage. As indicated in Table 3-1, the aeration blowers and effluent pumping account for approximately 65% of the energy use by the high energy use equipment.

Table 3-1: Major Equipment Inventory List
(Based on an average 365,400 kilowatts per month[(4)], 3.5 MGD wastewater)
(Major Equipment is defined as 10 hp or greater)

No.	Equipment Description	Equipment Size[1] (hp)	Equipment Load[2] (kW)	Est. Operational Hours[3] (hrs/yr)	Est. Energy Usage[4] (kWh/yr)
1	Administration / Maintenance Buildings - Estimated Load	---	9 kW average	3,500	31,500
2	Influent Odor Control Fan	20	1@13.5	8,760	118,000
3	Clarifier #1 & #2 RAS Pumps (2 units)	15	2@9=18	8,760	158,000
4	Clarifier #1 & #2 Backup RAS Pump	15	Standby	n/a	n/a
5	WAS Pumps #1 - #5 (5 units)	10	3@4.5=13.5	3,000	40,500
6	Digested Sludge Pump #1	10	1@2.4	2,920	7,000

No.	Equipment Description	Equipment Size[1] (hp)	Equipment Load[2] (kW)	Est. Operational Hours[3] (hrs/yr)	Est. Energy Usage[4] (kWh/yr)
7	Digested Sludge Pump #2	10	Standby	n/a	n/a
8	Aeration Primary Blowers (3 units)	300	1@210	7,296	1,532,200
9	Aeration Primary Blower New (1 new unit online by October 2009)	200	1@120	1,464	175,700
10	Aeration Blower Small Anoxic Mixing	60	1@45	500	22,500
11	Aerobic Digester Agitation Blowers (2 units)	60	1@30	8,760	263,000
12	Aerobic Digester Jet Aerator Blowers (3 units)	40	Standby	n/a	n/a
13	Centrifuges (2 units)	40	1@27	2,920	79,000
14	Sand Filter Sump Pumps (2 units)	60	1@30	8,760	263,000
15	Filter Compressor Station (2 units)	20	1@13.5	8,760	118,000
16	Plant Utility Water Pumps (3 units)	40	1@27	2,000	54,000
17	Reclaim Transfer Pumps (2 units)	20	1@13.5	8,760	118,000
18	Effluent Pumps (3 units)	150	1@99	8,760	867,000
19	UV Disinfection System (new)	10.2	1@9.2	8,760	80,000
20	Air Compressors (2 units)	40	1@34	7,957	270,500
21	Small Motor Load	30	16.5 kW average	8,760	144,500
22	Lighting Load	---	15 kW average	2,800	42,000
	TOTAL				**4,384,400[5]**

Notes:

1. The equipment size includes nameplate horsepower (hp) rating of the equipment.
2. The equipment load includes measured average amperage readings taken at the time of site on site survey to calculate power in kilo-watts (kW), considering the efficiency rating, if available, and operating characteristics.
3. Hrs/yr is hours per year.
4. Estimated energy usage (kWh/yr is Kilowatt-hours per year) is based on equipment and operating conditions. Energy use may not equal the product of the equipment size (kW) and the operating hours per year (hrs/yr) values shown.
5. The total site estimated energy use captures 95% or more of annual site energy use.

SECTION 4
Utility Analysis

Current Utility Use

The Kihei WWTP currently consumes and is billed for three types of utilities including Electricity, Water, and #2 Fuel Oil. Utility usage data and bills were reviewed between 2007–2009, or as available. According to this data, the site currently spends a total of over $960,000 annually for the site's energy and water usages. Almost 99 percent of this cost is from electrical energy use. The use and cost summaries for each of these utilities are detailed in the sections below.

Table 4-1: WWTP Typical Annual Utilities

Utility	Site Utility Use (common units)	Site Utility Use (equivalent units)	Site Utility Costs	% of Costs
Electricity	4,389,600 kWh	14,977 MMBTU	$946,000	99%
Water	3,726,000 gal	3,726,000 gal	$12,000	1%
#2 Fuel Oil	218 gal	31 MMBTU	$2,000	0.2%
Total		**15,008 MMBTU**	**$960,000**	**100%**

#2 Fuel Oil / Diesel Fuel

Maui Oil and Maui Petroleum are contracted suppliers to provide #2 fuel oil or diesel fuel to the WWTP. The diesel fuel is delivered to the site by truck and offloaded at the site's receiving tank. The users of this fuel at the site include the larger hauling trucks, and the diesel generator that provides backup electrical energy to the site in the event of an electrical power outage. The actual plant use is small, as the generator is typically run unloaded for about 1 hour monthly. Typical annual use is approximately 218 gallons, at a cost of approximately $2,000 per year.

Water

Purchased treated water is supplied to the WWTP. The city water is delivered to the site through a main supply pipe to onsite booster pumps with typical annual use of approximately 3,726,000 gallons, at an estimated cost of $12,000 per year.

Electricity

Maui Electric Company, Ltd., (MECO) provides electrical energy to the WWTP. The electrical energy is delivered through one transformer on site and one meter. Typical annual use is approximately 4,390,000 kilowatt hours, at a cost of approximately $946,000 per year. Table 4-2 provides a summary of the electrical energy use purchased from MECO for the Kihei WWTP for the period of December 2008, through November 2009.

Table 4-2: WWTP Monthly Electrical Energy Use

Billing Period	Electrical Energy Use (kWh)	Electrical Energy Cost ($)
Dec-08	357,600	$102,036
Jan-09	388,800	$90,238
Feb-09	360,000	$72,443
Mar-09	350,400	$71,264
Apr-09	396,000	$75,482
May-09	381,600	$70,524
Jun-09	415,200	$77,772
Jul-09	388,800	$77,172
Aug-09	357,600	$79,604
Sep-09	321,600	$72,372
Oct-09	352,800	$81,457
Nov-09	319,200	$76,053
Average (12 months)	**365,800**	**$78,868**
Total (12 months)	**4,389,600**	**$946,417**

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As shown in Table 4-3 below, approximately 82% of the site's total electrical energy charges were for electrical energy use charges, 17% for electrical energy demand charges, and the remaining 1% for customer charges and other surcharges not impacted by electrical energy use or demands.

Table 4-3: WWTP Monthly Electrical Energy Cost Influence

Billing Period	Billing Days	Electrical Energy Use Costs ($)	Electrical Energy Demand Costs ($)	Other Costs ($)	Total Electric Costs ($)
Dec-08	31	$86,779	$14,024	$1,233	$102,036
Jan-09	32	$74,745	$13,942	$1,550	$90,238
Feb-09	28	$56,950	$13,996	$1,497	$72,443
Mar-09	29	$55,932	$13,867	$1,465	$71,264
Apr-09	30	$59,972	$14,011	$1,498	$75,482
May-09	29	$56,068	$14,278	$178	$70,524
Jun-09	33	$64,697	$13,528	-$453	$77,772
Jul-09	32	$63,839	$13,206	$127	$77,172
Aug-09	30	$66,372	$12,990	$241	$79,604
Sep-09	30	$59,644	$12,487	$241	$72,372
Oct-09	32	$68,579	$12,637	$241	$81,457
Nov-09	29	$63,207	$12,605	$241	$76,053
Average (12 months)		**$64,732**	**$13,464**	**$672**	**$78,868**
Total (12 months)		**$776,785**	**$161,571**	**$8,061**	**$946,417**
Percent of Total		**82%**	**17%**	**1%**	**100%**

Table 4-4 provides a breakdown of the monthly measured peak power demands, monthly billed peak demands, and total MECO demand-influenced charges to the Kihei WWTP for the same 12-month period.

Table 4-4: WWTP Electrical Power Demand Summary

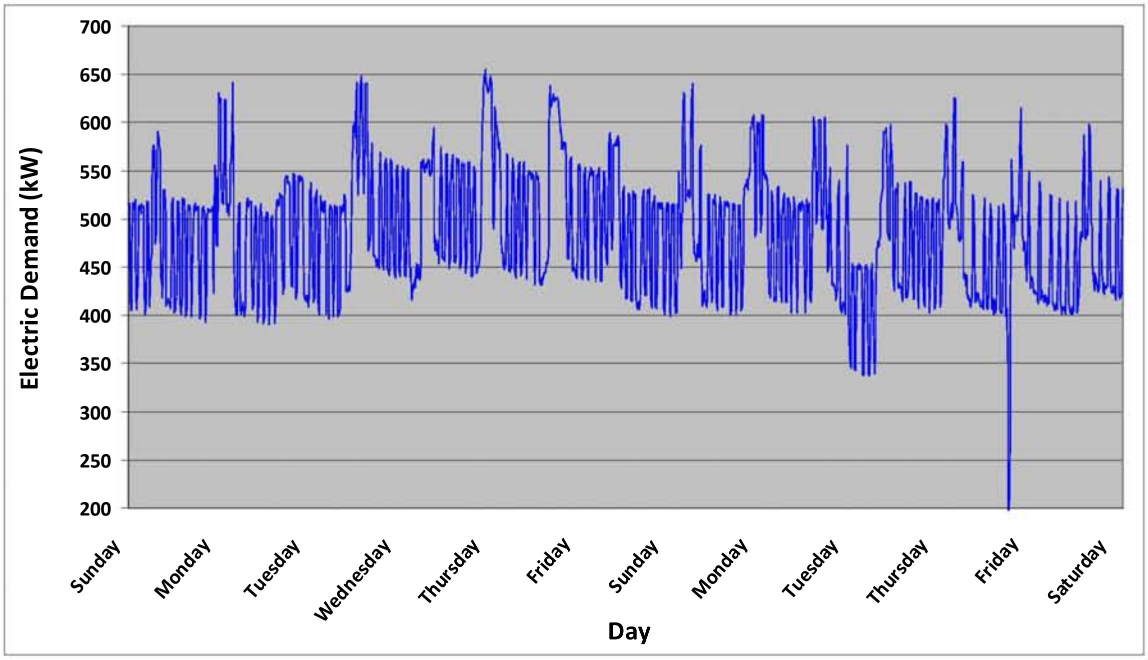
Bill Period	Measured Peak Demand (kW)	Billed Peak Demand (kW)	Total Demand Charge ($)
Dec-08	694	746	$14,024
Jan-09	686	743	$13,942
Feb-09	686	743	$13,996
Mar-09	672	736	$13,867
Apr-09	689	744	$14,011
May-09	718	758	$14,278
Jun-09	674	721	$13,528
Jul-09	638	703	$13,206
Aug-09	624	691	$12,990
Sep-09	610	664	$12,487
Oct-09	626	672	$12,637
Nov-09	622	670	$12,605
Average	**662**	**716**	**$13,464**
Total	**n/a**	**n/a**	**$161,571**

Note: The Total Demand Charge above represents the "demand charge" as defined in the utility schedule, in addition to all charges that are influenced by the monthly billed peak demand.

Monthly billed peak demands have been generally between 650 and 700 kW. The billed demand charges for use up to 500 kW has a base rate of $8.50 per kW, and $8.00 per kW above 500 kW. Billing demand for each month shall be the maximum average load in kW during any fifteen-minute period for such month, or the mean of current monthly maximum demand and the greatest maximum demand for the preceding eleven months, whichever is higher, but not less than the minimum billing demand of 200 kW. As Table 4-4 indicates, all demand was billed for the later case. This means that a prior monthly demand resulted in an inflated current demand charge. There were two months of measured demand within the prior 11-month period that caused this increase; these measured demands were May 09 (717.6 kW) and June 08 (799.2 kW). The highest maximum peak demand recorded in the last 12 months was in May 09 at 717.6 kW. The lowest maximum peak demand recorded was in September 09 at 609.6 kW.

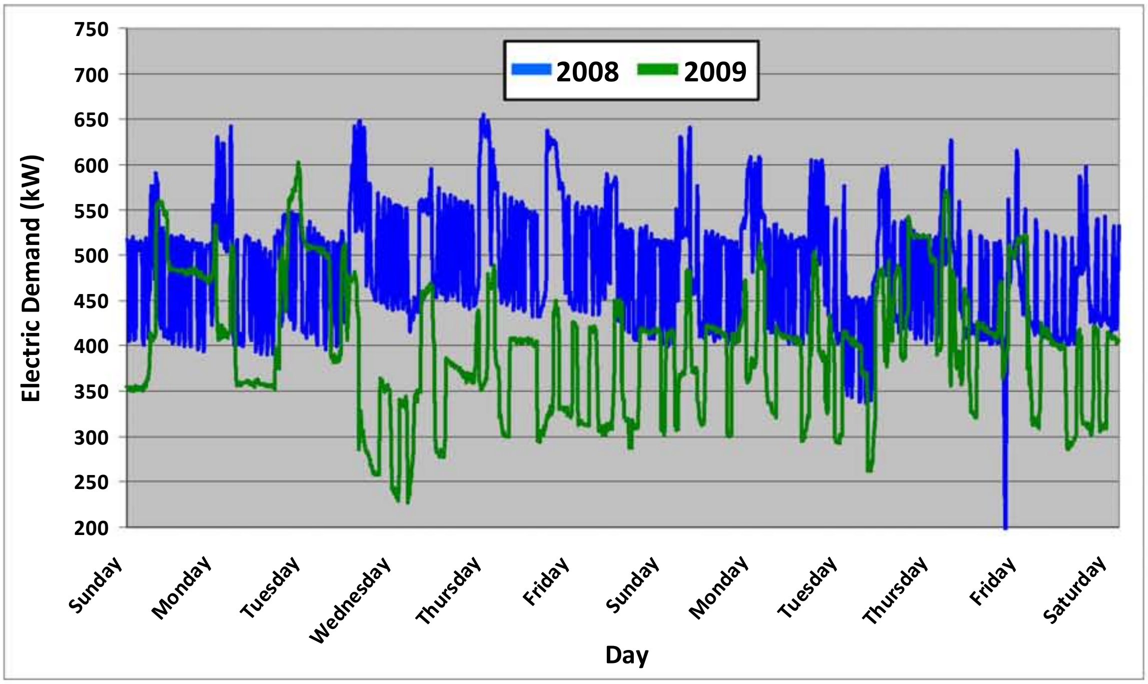
Below, Figure 4-1 provides a trend of the plant's electrical demand energy during a typical two week period. This information is recorded by the site's electric meter and is stored at MECO. Typically, this recorded information can be gathered from the utility provider or through remote access with an online interface. The site's electrical load profile is the variation of the plant's electrical energy demand over time.

Figure 4-1: WWTP Electrical Energy – 15 Minute Interval Demand Trend



A plant's electrical demand typically follows the influent flow volumes; as influent flows increase so does the amount of equipment online and hence an increase in electrical energy use. Since the plant is typically staffed during the day only, the demand energy for the site is elevated slightly during the day versus at night due to operations that occur only during these daytime periods, such as dewatering. This can be seen on the demand trend above in which daily operations rise to a level of approximately 600-650 kW during the day and drop to approximately 500 kW during the evening periods. Also notice that the plant measured peak demands, which are typically over 650 kW and occur at this level of demand only about once per month, or very infrequently. If this demand peak can be controlled, then the site is able to better manage this portion of the bill. The site is currently working on improving high demand systems at the plant. By the end of 2009, the plant has made a major impact to the electric demand by implementing a new aeration blower with a variable speed driven motor. Some initial impacts and results of such retrofits can be seen in the demand graphs as shown in Figure 4-2, which compares the first two weeks of December 2008 versus 2009.

Figure 4-2: WWTP Electrical Energy – 15 Minute Interval Demand Trend Two Week Comparison December 2008 versus 2009



The site electric demand information is valuable as it can provide instantaneous information about the amount of equipment operating at the site. Since approximately 17% of the site's electrical costs are determined from the monthly peak 15-minute interval demands, the site has been directly and positively impacting the influence over this portion of the bill.

Electricity Rate Schedule

The Kihei WWTP purchases electricity from MECO and is under the MECO Electric Tariff Schedule "P" for Large Power Service. Schedule "P" is applicable to large light and/or power service supplied and metered at a single voltage and delivery point.

As the site's actual electric bills were provided, a full breakdown of the site's electrical energy charges were calculated using the detailed rate schedule information as summarize below. Since electric use and electric load or demand contribute differently to the site's utility bill accounting factors, we separated these rates for improved accuracy when evaluating the individual Energy Conservation Opportunities and their expected impact on the site's future utility bills. As illustrated in Table 4-5, the electrical energy use rate was determined to be $0.181, calculated using the site's electrical energy use and costs for the most recent 12 month period. The electrical energy demand rate was determined to be $18.807/kW/month, using the site's electrical energy demand use and costs for the same 12 month period. These electric rates were utilized for estimating cost impacts of the Energy Conservation Opportunities provided in Section 5.

Table 4-5 describes the rates calculated from the WWTP's electric energy billed costs for the 12-month period from December 2008 through November 2009.

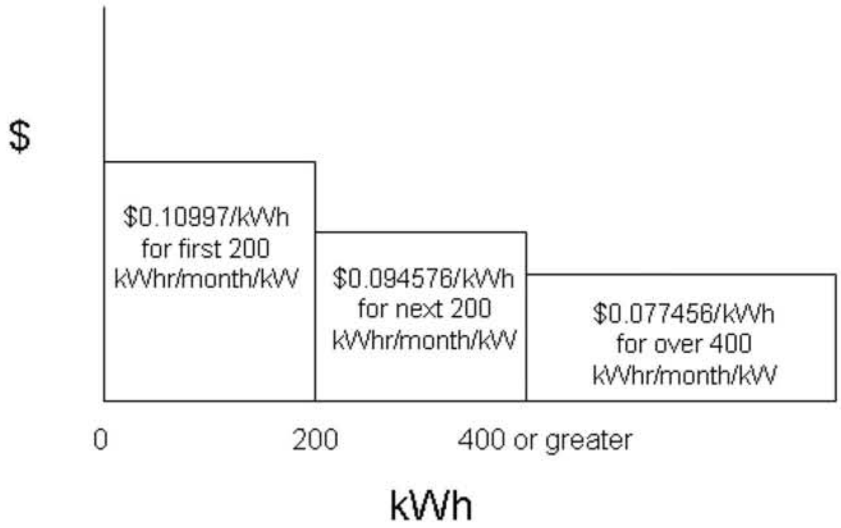
Table 4-5: WWTP Monthly Electrical Energy Use and Demand Rates Utilized for ECO Cost Impact for the Site

Billing Period	Billing Days	Electrical Energy Use & Costs	Electrical Energy Demand Use & Costs	Other Costs ($)	Total Electric Use & Costs
Total (12 months)		$776,785 /yr	$161,571 /yr	$8,061	$946,417 /yr
Total (12 months)		kWh/yr	kW/mo average	n/a	n/a
Rate Used for ECO Calculations		$0.181 /kWh	$18.807 /kW/mo	n/a	n/a

The electric service rate schedule for the site is broken down into the following charges, as of the date of this report:

- ***Customer Charge*** – this is a fixed fee of $225 per month and does not vary with use.
- ***Energy Charge*** – this is a declining block charge in which there is a set price for the first block of energy (kWh) used, and less for the next increment(s) of energy as more energy is used. The following blocks are currently set under Schedule P. Note that the energy charge is per kWh/month/kW of billing demand per kWh.

  For example, a site using 400,000 kWhs in a month with a billed demand of 750 kW would have a total energy charge of 200kWh x 750kw x $0.109997/first 200kWh + 200kWh x 750kw x $0.094576/next 200kWh + (400,000kWh – (400 x 750)) x $0.077456/over 400kWh = $16,499.5500 + $14,186.4000 + $7,745.6000 = $38,431.55 for that billing month.



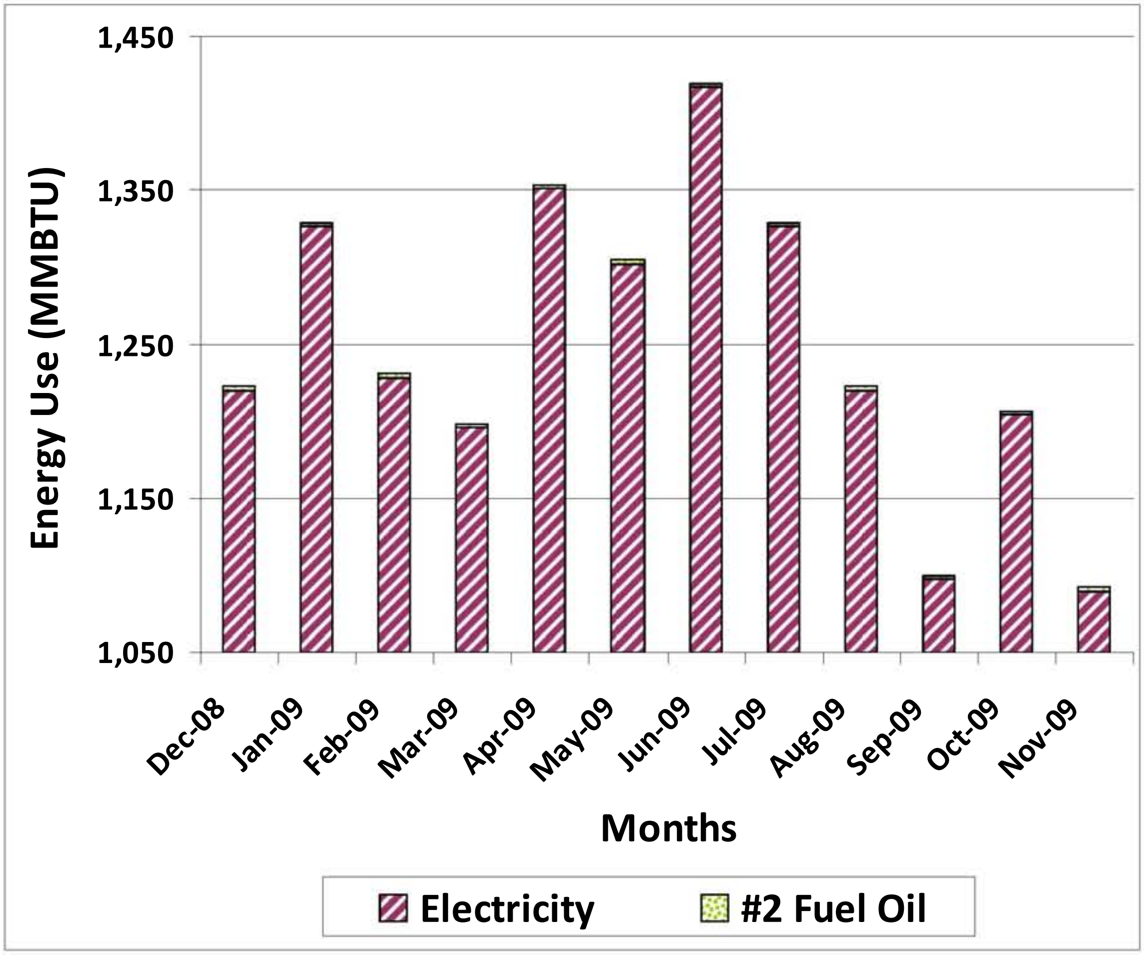
- ***Demand Charge*** – The demand charge is the maximum average load in kW during any fifteen-minute period. The billing demand for each month is the maximum average load in kW during any fifteen-minute period for such month or the mean of current monthly maximum demand, and the greatest maximum demand for the preceding eleven months, whichever is higher, but not less than the minimum billing demand of 200 kW. Like the energy charge, this is also a declining block charge. However, there are only two blocks which are 0-500kW at $8.50 per kW of billing demand, and over 500 kW at $8.00 per kW of billing demand. Since the site typically has a demand between 625-700 kW, it is typically charged for both blocks of demand rates.

- ***Power Factor*** – The above energy and demand charges are based upon an average monthly power factor of 85%. For each 1% the average power factor is above or below 85%, the demand and energy charges, as computed under the above rates, shall be decreased or increased, respectively, by 0.10%. Typically the site is at a 98%-99% power factor. This means it is given a credit each month for having high power factor. This credit is normally in the range of $500-$600 per month.
- ***2.0 DP Dist Prim*** – The above energy and demand charges receive a 2% distribution voltage discount for transforming the site voltage once delivered to the site's local transformer. This discount, or credit, is normally in the range of $700-$900 per month.
- ***Firm Capacity Surcharge*** – Effective January 1, 2010, this surcharge is at a rate of 0.071% and is applied to the customer, energy, demand, power factor, and 2.0 DP Dist Prim charges and credits. This normally results in a small credit, usually in the range of $30 per month.
- ***Rider Discount*** – Since the site is a 24-hour per day operation, with a typically steady electrical demand and energy use, the site is on the Rider "T" discount, which credits the site with $0.02/kwh discount for off-peak operating hours and charges a $0.01/kwh charge for on-peak operating hours. This typically results in a small credit to the plant in the range of $100-$200 per month.
- ***Interim Rate Increase*** – Effective December 21, 2007, an interim rate increase in the amount of 7.31% has been added to the site's monthly bill. This rate increase is applied to the Customer Charge, Energy Charge, Demand Charge, and Power Factor Credit, 2.0 DP Dist Prim Credit and Rider Discount. This additional cost typically increases the monthly bill by approximately $3,000 per month.
- ***Public Benefits Fund (PBF) Surcharge*** – Effective January 1, 2009, this charge is a set percentage of the total energy used in kWhs. Currently this rate is at $0.001015 per kWh. According to PUC documents, the PBF rate is set to increase over the next few years and then level off. This funding is to support investment in more sustainable alternatives to fossil fuel derived power needs. This charge typically increases the monthly bill by approximately $365 per month.
- ***Energy Cost Adjustment*** – This factor is evaluated each month and is charged to the energy used in kWhs. If the PUC approves MECO's submitted rate change, then the new rate goes into effect from that day forward until a new rate is approved. Since 2001, this rate has typically changed monthly. The days in the billing period are charged at the respective rates for such charges. In 2009, this rate averaged approximately $0.09 per kWh.
- ***Integrated Resource Planning (IRP) Cost Recovery*** – This charge supports the planning and other costs for MECO's Integrated Resource Planning programs. This charge typically increases the monthly bill by approximately $1,000 per month.

Energy Baseline

The following Figure 4-3 describes the site's energy use over the 12-month period from December 2008 through November 2009.

Figure 4-3: WWTP Total Energy Use Breakdown



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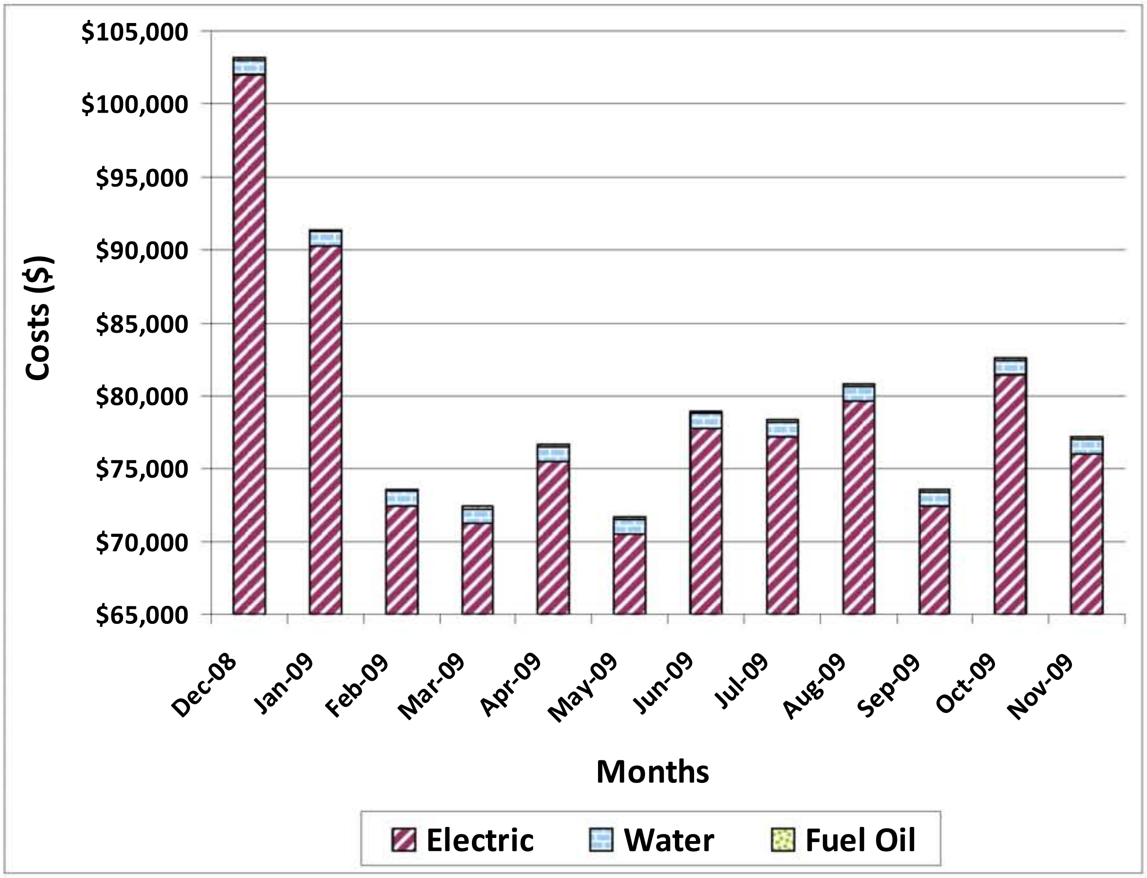
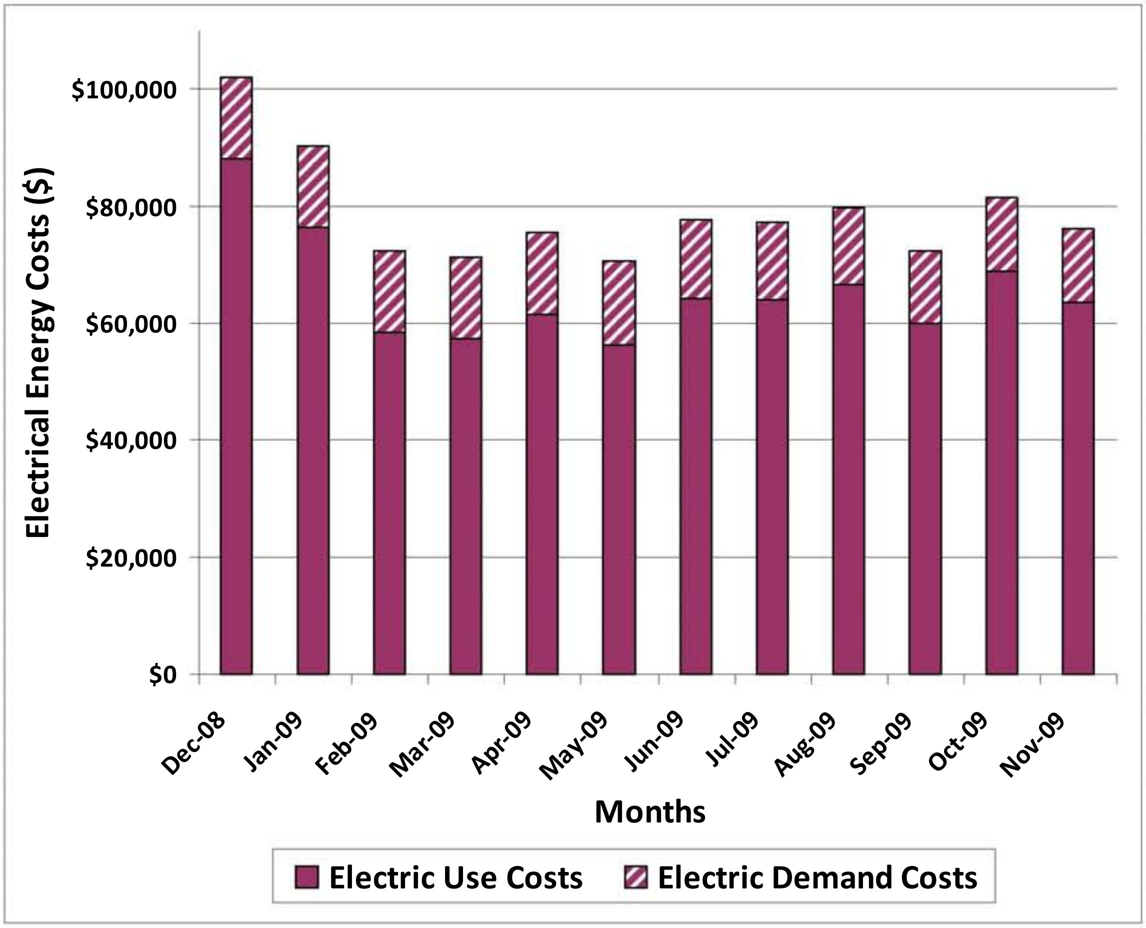
The following Figure 4-4 describes the site's energy costs over the same 12-month period, from December 2008 through November 2009. This illustration provides a view of the changes of the utility rates (specifically electrical rates) from 2008 to 2009, as oil prices in the world and region decreased significantly over the time period.

Figure 4-4: WWTP Total Energy (and Water) Cost Breakdown



The following Figure 4-5 describes the site's electrical energy costs over the same 12-month period, from December 2008 through November 2009. This illustration provides a breakdown of electric use costs versus electric demand costs. The site demand costs are on average approximately 17% of the electric bill each month.

Figure 4-5: WWTP Electric Energy Cost Breakdown



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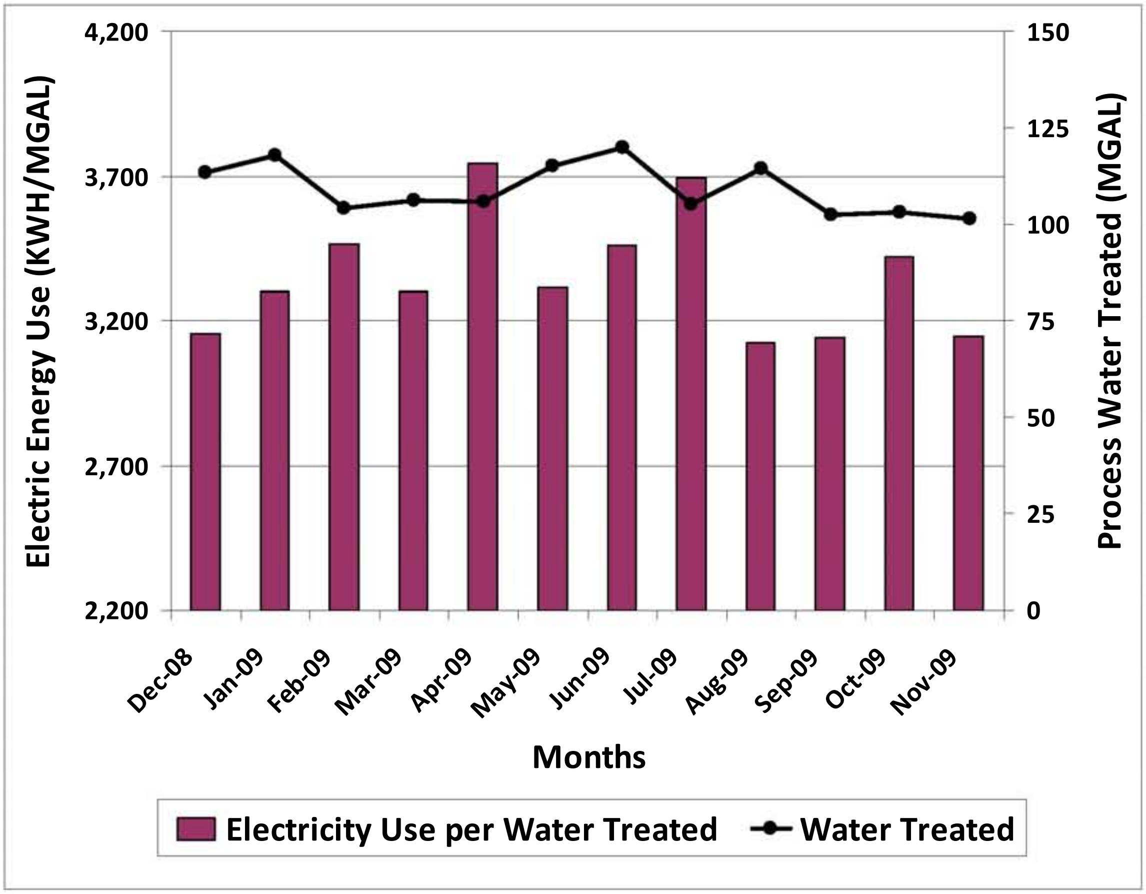
Since the site's major utility use is electric energy, the following Figure 4-6 illustrates an overall energy baseline for electric energy use per million gallons of wastewater treated. It shows the 12-month period from December 2008 through November 2009, and provides one productivity measurement of an energy utilization index to demonstrate deviations in electrical energy use over time. This offers both advantages and disadvantages in comparing year-to-year energy efficiency improvements and should not be used as a sole source of comparison.

Figure 4-6: WWTP Electric Energy Use Per Million Gallons of Wastewater Treated



SECTION 5
Energy Conservation Opportunities

ECO 1 – Effluent Pumping System Improvements

Recommendation

It is recommended that the Kihei WWTP considers equipping the effluent pump station with updated controls to monitor and track effluent water to the reclamation, plant Number 3 Water Pumping (3WHP) and injection well systems. Currently, it is unclear to what level the plant 3WHP water is utilized and advanced treated. It is also recommended to complete a water balance for the plant and reclamation end users to determine necessary line pressures for each location to improve pumping control strategies. A new control programmable logic controller (PLC) for reclaim water management with an energy demand and utilization module should assist in improving reclaim water energy use and plant energy management. Estimated energy, power demand, cost savings and simple payback from installations identified during the initial audit are summarized below.

Estimated Electrical Energy Savings	=	26,000 kWh/yr
Estimated Electrical Demand Savings	=	10 kW
Estimated Total Energy Cost Savings	**=**	**$7,000/yr**
Estimated Implementation Cost	**=**	**$25,000**
Simple Payback	**=**	**3.6 years**

Background

Currently the WWTP utilizes a series of pumps to manage the effluent disposal. The disinfected water is transferred to the onsite effluent storage pond via two variable frequency driven (VFD) pumps. From the effluent storage pond (covered basin), the plant water pumps and effluent pumps draw water and conveys the water to the various end-users. At the time of the site survey, the plant water pumps (3 total) were currently off. The effluent pump station consist of three 150 horsepower (HP) vertical turbine pumps equipped with VFDs. The effluent storage pond is maintained at a high level and the effluent pumps operate on a series of controls including Reclaim Water Reservoir Levels (Low/Low, Low and High). Currently, the effluent pumps pressurize the elevated Reclaim Water Reservoir system to 100 psig (230 feet of head) even though a large user of the reclaim water is the golf course which is adjacent to the treatment plant and at a lower elevation than the reservoir. If the Reclaim Water Reservoir is at a High level the effluent pumps stop and the excess effluent is diverted by gravity to the injection well system.

The goal of this ECO is to determine or confirm the various operating flow requirements and correlate with necessary line pressures. Once the flow requirements and pressures are determined, then an updated effluent management control system can be implemented to minimize higher than necessary pumping and pressurization of the effluent pumping system. This in turn would reduce such equipment electric loading.

Estimated Energy and Cost Savings

The current electrical energy used by the effluent pump station is estimated at approximately 867,000 kWh per year with a demand load of 99 kW. The effluent water balance study and updated control strategies are anticipated to reduce peak demand by upwards of 10 kW with a slight reduction operating hours or approximately 26,000 kWh per year.

The total estimated annual Cost Savings (CS) is the sum of the Electrical Energy Cost Savings (ECS) and Demand Cost Savings (DCS). The electrical energy and demand charges are based on the KIUC 2008-09 data as presented in Section 4.

CS = (ECS)(Usage Charge) + (DCS)(Demand Charge)
CS = [26,000 (kWh/yr) X 0.181 ($/kWh)] + [10 (kW) X 18.807 ($/kW–month) X 12 (months/yr)]
CS = $4,700/yr + $2,300/yr
CS = $7,000/yr

Estimated Implementation Cost and Payback

Prior to implementation of an updated effluent pumping control strategy, a comprehensive water balance should be completed to determine end-user effluent water requirements. Once the requirements are thoroughly understood, then an updated control strategy can be completed to utilize the low head reclaim transfer pumps when possible. Also, improved use of the plant water pumps for intermediate pressure zones can be developed. Determining reclaim water volumes and time of day needs for the golf course application would allow for improved clarification of reuse requirements for potentially improving the plants time of day electrical peak periods and reclaim water efficiencies.

Based on this preliminary assessment, a water balance study cost of $10,000 and a process control upgrade cost of $15,000 were estimated for a total ECO implementation cost of $25,000.

Based on this preliminary assessment, the simple payback period would be 3.6 years.
The following assumptions were made about this ECO:

1) Improving the sites effluent and water pumping pressurizations is estimated to improve such pumping energy use by 3% or approximately 26,000 kWh annually.
2) Improving the sites effluent and water pumping pressurizations is estimated to improve such pumping energy demands by 10 kW.
3) Impacts to time of day metering surcharges and/or credits were not included.
4) Cost savings estimated were based on current electric demand rates and cost adjustment factors. Future rates for the site may go up or down and would impact the cost savings estimates in this ECO accordingly.

The following steps are required to implement this ECO:

1) Complete a site and reclaim water balance study.
2) Confirm current system and user pumping pressurizations, typical flow volumes, and time of day needs.
3) Develop new control strategy options.

4) Confirm MECO Rider “T” rate schedule impacts with potential control strategy options.
5) Make necessary equipment and control retrofits and improvements.

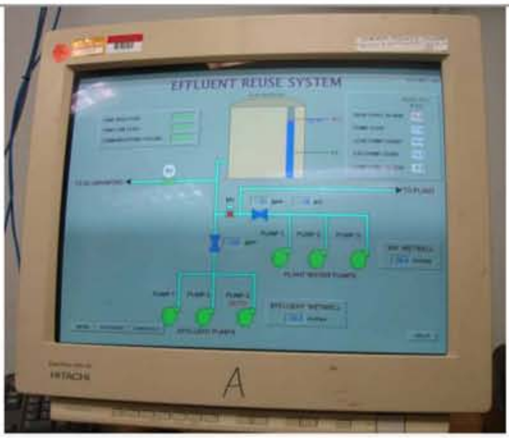
Plant Staffing Impact

Implementation of this ECO is not anticipated to impact plant staffing or operating requirements.

Photo Gallery

Effluent Pumping Station

Effluent Pumps



Existing Monitoring System for Effluent Reuse System

Reclaim Water Distribution

Onsite Covered Effluent Storage Pond

ECO 2 – Lighting System Improvements

Recommendation

It is recommended that the Kihei WWTP consider further investment in new, higher efficiency lighting technologies to reduce the site's electric demand and use. Replacing lower efficiency lighting systems with higher efficiency lighting systems will standardize lamp and ballast types and reduce the number of lamps, ballasts, and other lighting equipment to be stocked and managed. Fixture upgrades would include replacing all T12 fluorescent lamps with T8 fluorescent lamps. Also, we recommend replacing magnetic ballasts with electronic ballasts for further energy load improvement of the fixtures. Other upgrades include considering replacement of HID fixtures with LEDs for improved control and to significantly reduce maintenance costs. Lighting controls are also recommended in order to optimize lamp energy use and extend lamp life. Estimated energy, power demand, cost savings, and simple payback from such installations are summarized below.

Estimated Electrical Energy Savings	= 22,700 kWh/yr
Estimated Electrical Demand Savings	= 4 kW
Estimated Total Energy Cost Savings	**= $5,000/yr**
Estimated Implementation Cost	**= $43,000**
Simple Payback	**= 8.6 years**

Background

The Tetra Tech team observed that portions of the interior and exterior lighting, in several locations of the plant, have already been upgraded to new lighting technologies. These upgrades include replacing fluorescent fixtures containing T12 lamps and magnetic ballasts with new fluorescent fixtures containing T8 lamps and electronic ballasts. The site is already working towards improving the remainder of the lighting systems at the WWTP and this ECO is only identifying those further needs and quantifying the expected impact to the site's utility use and costs. Therefore, the lighting improvements identified in this ECO are for future improvements only.

There are approximately 160 interior and exterior fixtures at the site that use older generation lighting technologies. Most of theses fixtures were installed when the building or area was erected. This older lighting technology includes T12 fluorescent, incandescent, and High Pressure Sodium lamps and fixtures which also use magnetic ballasts.

The plant runs continuously throughout the year. The site is occupied with operations personnel on one shift, six days a week. Therefore, building lighting systems are typically on during daily operations. During the evening hours, when the site is unoccupied, the interior building lighting systems are shut down. The current controls for these fixtures are manual switches. The exterior lighting systems are on either photocells or time clock controls, and were observed off during the day. These units automatically turn on during very low/no light evening periods. Not including the cost of maintenance and

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replacement lamps and ballasts, it is estimated that the Kihei WWTP is spending over $10,000 per year for the energy to light the areas of the plant. This estimate is based on light counts and information collected during the site walk.

Many of these lighting systems can be replaced with more efficient, i.e. lower wattage lamps and ballasts. While replacing the lamps is a short term solution, Light Emitting Diodes (LED) is an example of a longer term solution. For instance, LED lamps are rated for approximately 100,000 hours, while high pressure sodium (HPS) lamps, currently used by the site, are rated for just a fraction of this lamp life at approximately 24,000 hours. The initial cost of LED maybe higher than HPS lamps, yet they consume minimal energy and require less equipment and maintenance costs, which can aide in justifying the use of LED. It is recommended that the site consider such alternative technologies when ultimately deciding on fixture replacement purchases.

Recommended control improvements include motion sensors or timer based switches for the building interior lighting systems. Several outdoor fixtures use controls such as photocells, as recommended for such applications. The site has already considered eliminating site outdoor lighting during unoccupied periods. Efforts are being made to identify circuits so a small portion of this lighting remains on for security purposes. If this change is implemented, then it may have further reduction impacts to the recommendations in this ECO.

Estimated Energy and Cost Savings

The estimated electrical demand energy savings, if all fixtures and lamps were replaced with the higher efficiency ballasts and lamps, and operating at the same current conditions, is 4 kW. Based on the current operating hours for lighting, the energy savings would be 22,700 kWh per year.

The total estimated annual Cost Savings (CS) is the sum of the Electrical Energy Cost Savings (ECS) and Demand Cost Savings (DCS). The electrical energy and demand charges are based on the MECO 2008-09 data as presented in Section 4.

CS = (ECS)(Usage Charge) + (DCS)(Demand Charge)
CS = 22,700 (kWh/yr) X 0.181 ($/kWh)] + [4 (kW) X 18.807 ($/kW–month) X 12 (months/yr)]
CS = $4,100/yr + $900/yr
CS = $5,000/yr

Estimated Implementation Cost and Payback

The total preliminary estimated cost to implement this ECO is $43,000. This estimate includes the cost for new lighting fixtures, ballasts, lamps and installation.

Based on this preliminary assessment, the simple payback period would be 8.6 years.
The following assumptions were made about this ECO:

5) Lamps and fixture prices remain the same.
6) Light counts are estimates.

7) Interior lighting operates an average 8 hours per day, 6 days per week.
8) Exterior lighting operates an average 12 hours per day, 365 days per year.
9) Reduced lamp replacement costs (equipment and labor), due to extended lamp life expectancies for new lighting technologies, were not included in the savings estimates.
10) Energy savings from improved control and/or reduced operating hours were not included here.
11) Cost savings estimated were based on current electric demand rates and cost adjustment factors. Future rates for the site may go up or down and would impact the cost savings estimates in this ECO accordingly.

The following steps are required to implement this ECO:

1) Confirm lighting fixture efficiency and operating hours.
2) Confirm lighting levels and acceptability of new fixture types and controls.

Plant Staffing Impact

Implementation of this ECO is not anticipated to impact plant staffing requirements.

Photo Gallery

Indoor T12 Fluorescent Lighting

Outdoor Site Lighting

Outdoor Site Lighting

ECO 3 – Compressed Air System Improvements

Recommendation

It is recommended that the Kihei WWTP consider investment in new, higher efficiency compressors and components to reduce the site's compressed air use and improve electric demand and operating efficiencies of the compressed air system at the facility. Due to the current age of the existing system, upgrades recommended include replacement of the two compressors, their controls, the receiver tank, the cycling refrigerated air dryer, and all condensate drain traps. It is also recommended that the site conduct a thorough compressed air system survey and analysis to determine the end devices using compressed air at the facility, the capacity and quality of air needed for such loads, and to further reduce compressed air use by determining more cost effective alternatives, if available. The findings of such an analysis would also assist in determining future compressor equipment sizing requirements necessary to support the site. Estimated energy, power demand, and cost savings, simple payback, and implementation costs for the equipment upgrades are summarized below.

Estimated Electrical Energy Savings	= 105,700 kWh/yr
Estimated Electrical Demand Savings	= 6 kW
Estimated Total Energy Cost Savings	**= $20,500/yr**
Estimated Implementation Cost	**= $130,000**
Simple Payback	**= 6.3 years**

Background

The site currently has two single stage, rotary screw, belt driven air compressors that provide on average, approximately 115psig and 150cfm compressed air to the site. Only one compressor is typically needed and operated to provide site air needs. Each compressor contains a 40 hp motor with capacity of 163 cfm per unit at 125psig. These units are controlled by a sequencer to balance the operating hours between compressors automatically. The local compressor controls provide for three types of operating modes for control regulation of the fixed speed compressors including on-line/off-line control, upper range modulation, and automatic stop/start control. The units are currently operated locally with on/off line control. This means the inlet vane of the unit closes as the site's compressed air needs decline. The unit will continue to require about 40% of the electric power even though less supply air is being allowed to enter the unit for compression. Metered electric readings confirmed this operation during both loaded and unloaded conditions. This operation could be optimized by placing the units into modulation or automatic start/stop control as depicted in Figure 5-1 below.

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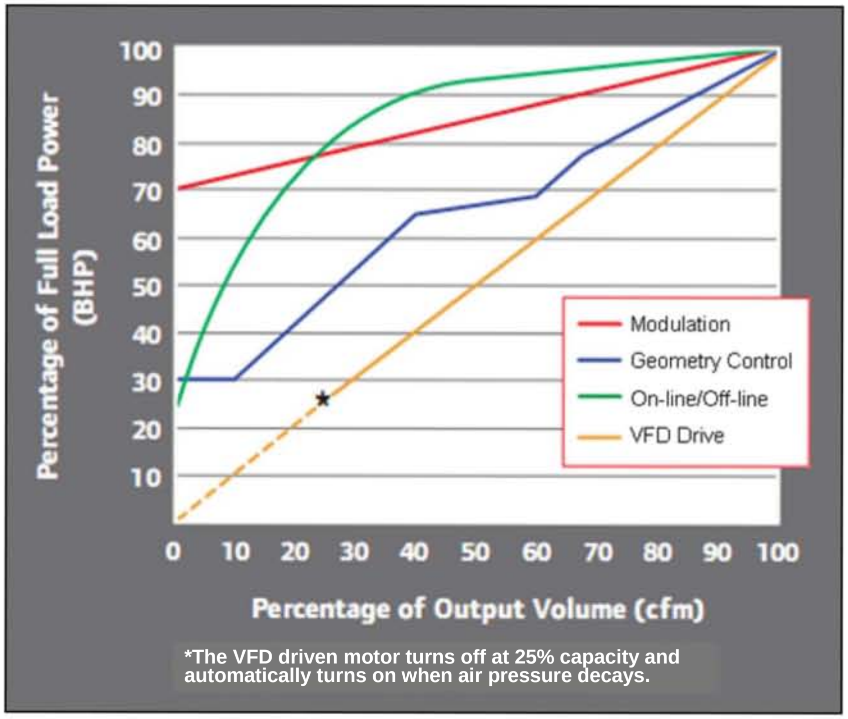
Figure 5-1: Comparison of Rotary Compressor Capacity Controls



The most efficient compressor operation for a site where compressed air needs vary over time is use of a variable speed driven unit, as opposed to fixed speed. As can be seen in Figure 5-1 above, a variable frequency drive (VFD) allows the compressor to reduce energy use as site air flows diminish, and to do so in a more efficient manner than that of a fixed speed driven compressor. It is also recommended the site further assess replacement of belt driven units with direct drive. Belt driven units tend to have lower drive efficiency than direct drive units on the market today. Direct drive units typically can have drive efficiencies of 97% or more, while belt driven drives tend to have, at best 92-94% drive efficiencies, which lose some efficiency in the drive mechanism due to the tendency of increased belt slippage over time. Therefore, direct drive efficiency of a VFD unit provides an improved output efficiency of at least 3-5% above that of the belt drive units at the site.

The existing compressors and auxiliary systems were installed at the site almost 16 years ago. Compressor motor efficiency varies slightly with load, and is between 91.4%-93%. The compressor is belt driven with drive efficiency rating between 92.4%-93.8% which also varies with load and over time, between re-tensioning. In comparison, the VFD compressor has motor efficiencies between 92%-94% and a drive efficiency of 97%.

The compressed air auxiliary systems include a 240 gallon air receiver, a system air filter, and cycling type refrigerated air dryer. All of the sites compressed air produced flow through these auxiliary systems. Timer based automatic condensate traps are located on each compressor, the air receiver, and air filter tank. All are operating correctly except for one drain trap in which the bypass valve has been left slightly open for continuous drain of condensate from the unit.

From equipment log sheets obtained from the site (see Table 5-1 below), it was observed that compressor total run hours and loaded run hours are recorded on a daily basis. Comparing total run hours and loaded run hours from day to day, the compressors, on average, are operating in a loaded condition for approximately 15 hours per day. This correlates to the units producing compressed air for an estimated 5,049 hours per year or 58% of the time. Since the units are in on-line/off-line control, they are in an unloaded condition for much of the remainder of the hours, or approximately 2,908 hours per year.

Table 5-1: WWTP Compressor Log

	Unit #1				Unit #2		
Date	Total Hours	Loaded Hours	% Loaded		Total Hours	Loaded Hours	% Loaded
9/1/2009					48,751	43,850	
diff					24	14	58.3%
9/2/2009					48,775	43,864	
diff					25	14	56.0%
9/3/2009					48,800	43,878	
diff					24	18	75.0%
9/4/2009					48,824	43,896	
diff					25	19	76.0%
9/5/2009					48,849	43,915	
diff					20	12	60.0%
9/6/2009					48,869	43,927	
diff					23	14	60.9%
9/7/2009					48,892	43,941	
diff					20	11	55.0%
9/8/2009					48,912	43,952	
diff					24	14	58.3%
9/9/2009					48,936	43,966	
diff					24	14	58.3%
9/10/2009					48,960	43,980	
diff							
9/11/2009	410	256					
diff	29	18	62.1%				
9/12/2009	439	274					
diff	23	15	65.2%				
9/13/2009	462	289					
diff					25	14	56.0%
9/14/2009					48,985	43,994	
diff					19	12	63.2%
9/15/2009					49,004	44,006	
diff					19	11	57.9%
9/16/2009					49,023	44,017	
diff					25	15	60.0%
9/17/2009					49,048	44,032	
diff	20	12	60.0%				
9/18/2009	482	301					
diff	30	24	80.0%				
9/19/2009	512	325					
diff	22	13	59.1%				
9/20/2009	534	338					

	Unit #1				Unit #2		
Date	Total Hours	Loaded Hours	% Loaded		Total Hours	Loaded Hours	% Loaded
diff	19	12	63.2%				
9/21/2009	553	350					
diff	24	15	62.5%				
9/22/2009	577	365					
diff	24	15	62.5%				
9/23/2009	601	380					
diff					23	18	78.3%
9/24/2009					49,071	44,050	
diff	24	14	58.3%				
9/25/2009	625	394					
diff	25	18	72.0%				
9/26/2009	650	412					
diff	24	17	70.8%				
9/27/2009	674	429					
diff	22	14	63.6%				
9/28/2009	696	443					
diff					24	14	58.3%
9/29/2009					49,095	44,064	
diff					24	14	58.3%
9/30/2009					49,119	44,078	
Mo. Ave.	24	16	65.4%		23	14	62.0%
Mo. Total	286	187	65.4%		368	228	62.0%
Annual Est.	3,480	2,275	65%		4,477	2,774	62%
Annual Est.	**7,957**	**Total Run hr/yr**			**5,049**	**Total Loaded Run hr/yr**	

Estimated Energy and Cost Savings

The estimated electrical demand energy savings, if the compressors and traps were replaced with the higher efficiency units and operating at current conditions, is 6 kW. Based on the current operating hours for each compressor, the energy savings would be 105,700 kWh per year.

The total estimated annual Cost Savings (CS) is the sum of the Electrical Energy Cost Savings (ECS) and Demand Cost Savings (DCS). The electrical energy and demand charges are based on the MECO 2008-09 data as presented in Section 4.

CS = (ECS)(Usage Charge) + (DCS)(Demand Charge)
CS = [105,700 (kWh/yr) X 0.181 ($/kWh)] + [6 (kW) X 18.807 ($/kW–month) X 12 (months/yr)]
CS = $19,100/yr + $1,400/yr
CS = $20,500/yr

Estimated Implementation Cost and Payback

The total preliminary estimated cost to implement this ECO is $130,000. This estimate includes the cost for two new 40hp, variable frequency drive, single stage, rotary air compressor packages; new sequencer, new 240 gallon air receiver, new refrigerant dryer, and new zero flow condensate traps, and installation.

Based on this preliminary assessment, the simple payback period would be 6.4 years.

The following assumptions were made about this ECO:

1) The new compressors will be left to operate in automatic mode in which they will automatically stage compressor operation for best efficiency of the system.
2) The current compressor operating loads were calculated at 99.6% from metered measurement of 55.8amps during loaded conditions and 29amps during unloaded conditions. If the units are operating at lower average loads, then the savings from installing a VFD driven compressor may vary and may increase current savings estimates.
3) Current condensate drain timer settings were observed at: 2 seconds on, 10 minutes off for the traps at the compressors, and 15 seconds on, 10 minutes off at the receiver tank.
4) Compressed air pressure at compressor condensate drains was estimated at 115 psig and 115 cfm through a ¼ inch drain valve opening.
5) Compressed air pressure at receiver tank condensate drain was estimated at 100psig and 100cfm through a ¼ inch drain valve opening.
6) The condensate drain bypass valve was open slightly at the air filter tank due to an inoperable trap. The flow estimated at this bypass was 5cfm for 100psig air.
7) Project implementation cost estimates include: $60,000 for equipment, $50,000 for installation labor, and $20,000 for engineering and project management.
8) Costing for a compressed air system survey and analysis was not included in the equipment upgrades and installation costs. This effort should be capable of self funding and funds appropriated accordingly.
9) Cost savings estimated were based on current electric demand rates and cost adjustment factors. Future rates for the site may go up or down and would impact the cost savings estimates in this ECO accordingly.

The following steps are required to implement this ECO:

1) Confirm site’s equipment air demand needs.
2) Confirm current air compressor loading over operating hours.
3) Add compressor performance evaluation to site PM process to continuously assess cost of compressed air for future replacement, and/or elimination of devices that utilize this most expensive source of energy at the site.

Photo Gallery

Sites Existing Compressors – Ingersoll Rand 40hp, Fixed Speed, Rotary Screws

Sites Existing Air Condensate Drains – Timer Based Traps

SECTION 6
Sustainable Energy Opportunities

An evaluation of sustainable design concepts was performed to identify opportunities for incorporating innovative initiatives, such as renewable energy alternatives at the Kihei Wastewater Treatment Plant. The following table lists the sustainable design options evaluated at this facility for energy use impact and/or the opportunity to improve the site's environmental impact. Recommendations are provided for those options the site should consider for further feasibility.

Table 6-1 Sustainable Energy Opportunities

SUSTAINABLE OPPORTUNITY	DESCRIPTION	RECOMMENDED NEXT STEPS	PAYBACK
Behavioral Modifications	Facility personnel practices have the potential to impact energy use significantly. Manual procedures or use of automated controls to lower conditioned air settings when an area is vacant and turning off lights and equipment when not needed or in use will result in increased energy savings at all levels of the facility. The facility has already taken a proactive step in this awareness, and automation, such as use of motion sensors for lighting and air conditioner control, would improve this effort slightly and more consistently.	Further evaluate opportunity when implementing new lighting fixtures and for administration and laboratory air conditioning systems.	Short Term
Green Procurement	Environmentally responsible or 'green' procurement is the selection of products and services that minimize environmental impacts. It requires an organization to carry out an assessment of the environmental consequences of a product at all the various stages of its lifecycle. This means considering the costs of securing raw materials, and manufacturing, transporting, storing, handling, using and disposing of the product. Opportunities at the WWTP may include the purchase of energy efficient IT systems such as energy star rated computers and appliances. The purchase of green products for cleaning and IT equipment typically do not cost more than alternative products.	Requires further study	Short Term
Plant Vehicle Fuel Options	The plant currently utilizes multiple vehicles for transportation and maintenance purposes. As vehicles are due to be replaced the site should consider use of hybrid or alternative fuel models. An alternative fuel vehicle could also be considered when deciding on new vehicle purchases.	Requires further study	Short to Mid Term
Effluent Water Reuse	The plant currently provides advance water treatment and reclamation resources to the adjacent business and parks. The plant uses a relatively small amount of potable water at approximately 4 million gallons per year.	Conduct a potable water minimization study.	Short to Mid Term
Fats, Oils & Grease (FOG)	The agency has a FOG collection system and the FOG is added to the composting operations (per plant personnel).	Continue current use. If cogeneration or bio-diesel production opportunities are made available, consider diverting FOG such operations.	Mid to long Term
Solar Renewable Energy	The Kihei WWTP currently has limited open space to the north and east of the facility. District looked at Photo Voltaic opportunity which was determined at > 15 year pay back.	Monitor costs of PV and availability of incentive funds.	Long Term
Wind Renewable Energy	Wind generators are visible to the west on the mountainside. The treatment plant is located in a saddle area on the island. Visual aesthetics and possible flight restrictions may prevent development of resource.	Investigate wind resource, height and associated flight restrictions.	Long Term

Payback Range Estimate: Short Term = <5 years; Mid Term = 5 years to 10 years; Long Term = > 10 years

SECTION 7
Additional Energy Conservation Considerations

During the course of the site visit and in review of the planned wastewater treatment plant expansion, a review of the proposed upgrades was conducted identifying additional missed energy and cost savings related to resource conservation. While Tetra Tech was unable to detail these opportunities within the limits of this initial study, these items warrant further attention, whether requiring additional study or simply operations and maintenance actions. Table 7-1 lists the opportunities noted, and explains the nature of actions required to capitalize on the items listed.

Table 7-1 Additional Energy Conservation Considerations

ECO OPPORTUNITY	ECO DESCRIPTION	RECOMMENDED NEXT STEPS	PAYBACK
Energy Tracking	The plant is currently tracking and trending the site's energy use and demands to enhance the site's knowledge of energy use at the site and to verify energy reduction strategies implemented. The site is currently in the process of improving the site's SCADA system. The electrical information from the meters should be considered for adding to this system. Also, the site should consider keeping track of water use and costs.	Incorporate electric metering with SCADA system improvements.	Short Term
UV Disinfection Upgrade	The facility recently installed a Trojan 3000+ UV system with self monitoring and self cleaning. The savings and electric demand reductions have been substantial (70%+ Reduction.) The facility has requested a back-up UV system for additional reliability.	Provide 2nd train of high efficiency UV.	Short Term
Aeration Blower Upgrade & DO Control Package	The facility has recently installed a Trublex High Efficiency Blower package with limited dissolved oxygen control. The blower has dramatically reduced the energy usage and electrical demand. Installation of dissolved oxygen process controls may further enhance the energy reduction and subsequent savings.	Investigate and retrofit DO control system.	Short Term
Aerobic Digester – Biological Treatment Study	The site has implemented a pilot study using one of the existing aerobic digesters as a test tank for use of "bugs" instead of air to stabilize the solids. The verdict was unknown during the time of the site audit as to the viability of the biological process. Continue to monitor the new technology(ies).	Requires further study	Short to Mid Term
Lower Efficiency Motors	The site has already done an exemplary job in replacing the larger, older, lower efficiency motors with higher efficiency units. There were a few smaller motors, such as the potable water booster pump motors, found at the site with efficiencies lower than 90%. Even though a motor does not run 24x7, replacement with a higher efficiency unit can still show fairly good payback for such improvements. The site should consider surveying all motors greater than 1hp in size to review the opportunity for replacement.	Survey all motors >1hp for their efficiencies and operating hours.	Short to Mid Term
Lighting Systems Optimization	The building and outdoor lighting currently utilize older, inefficient technologies. Some of these components will be obsolete in the near future and even unavailable for purchase. Lighting system replacements are recommended and described in ECO #1 of Section 5 of this report. Further evaluation of the controls and automation of this system is recommended..	Review ECO #1 for implementation.	Short to Mid Term
Compressed Air System Improvements	The site requires compressed air at various pressures. The current compressor equipment and controls systems are older, lower efficiency systems in comparison with technologies available on the market today. It is recommended that the compressed air system and distribution are investigated for opportunities in flow, pressure, and frequency of use reductions in addition to compressor and auxiliary system equipment replacement and improvements as described in ECO #2 of Section 5 of this report.	Review ECO #2 for implementation.	Short to Mid Term

Payback Range Estimate: Short Term = <5 years; Mid Term = 5 years to 10 years; Long Term = > 10 year

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